PUBLIC SAFETY ELEMENT

NEWPORT BEACH GENERAL PLAN

PUBLIC SAFETY ELEMENT

NEWPORT BEACH GENERAL PLAN

(Including Safety and Seismic Safety Elements as required by State Law.)

ADOPTED AND RECOMMENDED FOR APPROVAL BY THE PLANNING COMMISSION

FEBRUARY 6, 1975

ADOPTED BY THE CITY COUNCIL

MARCH 10, 1975

RESOLUTION NO. 908

A RESOLUTION OF THE PLANNING COMMISSION OF THE CITY OF NEWPORT BEACH ADOPTING THE PUBLIC SAFETY ELEMENT OF THE NEWPORT BEACH GENERAL PLAN

WHEREAS, a phase of the City's General Plan Program has involved the preparation of a Public Safety Element; and

WHEREAS, said Public Safety Element sets forth objectives and supporting policies which will serve as a guide for the future planning and development of the City; and

WHEREAS, pursuant to Section 707 of the City Charter of the City of Newport Beach, the Planning Commission has held public hearings to consider the adoption of the Public Safety Element of the Newport Beach General Plan.

NOW, THEREFORE, BE IT RESOLVED that the Planning Commission does hereby adopt and recommend to the City Council the Public Safety Element of the Newport Beach General Plan described above, a copy of which is on file in the Newport Beach Community Development Department.

Regularly passed and adopted by the Planning Commission of the City of Newport Beach held on the 6th day of February, 1975.

AYES: Agee, Beckley, Hazewinkel, Heather, Parker, Seely, Williams

NOES: None

ABSENT: None

William C. Hazewinkel
Chairman

James M. Parker
Secretary

RESOLUTION NO. 8449

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF NEWPORT BEACH ADOPTING THE PUBLIC SAFETY ELEMENT OF THE NEWPORT BEACH GENERAL PLAN.

WHEREAS, a phase of the City's General Plan Program has involved the preparation of a Public Safety Element; and

WHEREAS, said Public Safety Element sets forth objectives and supporting policies which will serve as a guide for the future planning and development of the City; and

WHEREAS, the Planning Commission of the City of Newport Beach, pursuant to Section 707 of the Newport Beach City Charter, has held a public hearing to consider the adoption of the Public Safety Element as a part of the City's General Plan and has adopted and has recommended that the City Council adopt said element; and

WHEREAS, the City Council has conducted a public hearing to consider the adoption of the Public Safety Element as a part of the City's General Plan.

NOW, THEREFORE, BE IT RESOLVED that the City Council of the City of Newport Beach does hereby adopt as a part of the General Plan the Public Safety Element described above, a copy of which is on file in the office of the City Clerk.

ADOPTED this 10th day of March, 1975.

Donald A. McInnis
Mayor

ATTEST:

Laura Lagios
City Clerk

CITY OF NEWPORT BEACH
CALIFORNIA

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INTRODUCTION

Natural occurrences, such as the San Fernando earthquake in 1971, the tsunami damage to Cresent City in northern California in 1964, and the flood damage throughout Orange County due to the relatively minor 1969 storms, forcibly remind us that we live in an active and potentially hazardous environment.

The first three sections of the Public Safety Element identify the major potential natural physical hazards which could affect the Newport Beach planning area. Maps located in each of these sections delineate areas of concern in terms of risk from Geologic, Flood and Fire Hazards. A review of the adopted Emergency Operation Plan for the City follows the aforementioned sections.

The final portion of the Element describes the method by which the City will address potential public safety hazards. It is in this final portion of the Element that the City establishes the "level of risk" it deems acceptable and the risk reduction program policies designed to achieve this level.

PURPOSE AND SCOPE

The purpose of this Element is to introduce safety considerations in the planning process in order to reduce loss of life, injuries, damage to property, and economic and social dislocation resulting from fire, flood, and dangerous geologic occurrences. It is intended that this Element serve as a review of the natural physical hazards in the Newport Beach planning area, and provide for public safety considerations in the physical development of the City of Newport Beach. This Element does not include a comprehensive disaster plan, civil defense plan, crime prevention or other safety programs since the General Plan is a guide to the physical development of Newport Beach and does not include such "governmental-program" planning. This Element is intended to provide a basis for reducing the hazards to public safety resulting from the geographical setting and physical development of the City of Newport Beach.

It is further intended that this Element satisfy the State requirement that local General Plans contain a "Safety Element", a "Seismic Safety Element" and identify areas subject to flood hazard. Section 65302 of the Government Code states, in part, that the General Plan shall include:

1. "A safety element for the protection of the community from fires and geologic hazards including features necessary for such protection as evacuation routes, peak load water supply requirements, minimum road widths, clearances around structures, and geologic hazard mapping in areas of known geologic hazard."

2. "A seismic safety element consisting of an identification and appraisal of seismic hazards such as susceptibility to surface ruptures from faulting, to ground shaking, to ground failures, or to the effects of seismically induced waves such as tsunamis and seiches.

The seismic safety element shall also include an appraisal of mudslides, landslides, and slope stability as necessary geologic hazards that must be considered simultaneously with other hazards such as possible surface ruptures from faulting, ground shaking, ground failure and seismically induced waves."

This Element includes consideration of natural physical hazards in three major sections:

Section 1 - Geologic Hazards

Section 2 - Flood Hazards

Section 3 - Fire Hazards from Undeveloped Areas

Sections 1 and 2 are based on the "Geologic-Seismic Study", October, 1972, conducted by Woodward-McNeill and Associates under contract with the City, with additional input on flood hazards from the Coast and Geodetic Survey, the Army Corps of Engineers, and Moffatt and Nichol, Engineers.

Section 3 has been developed in conjunction with the Newport Beach Fire Department. The risks to public safety from fire hazard within existing urban structures will not be considered in this Element. Appropriate sections of the Community Facilities Element will address this issue in terms of facilities, locations, response times and other associated factors.

The last section of this Element includes a "Risk Reduction Program" which contains those land development regulations, restrictions, and other actions which are considered by the City of Newport Beach to be reasonable and practical, in order to assure that the future development of the City does not result in increased risk to life and property from natural environmental hazards.

SECTION 1 - GEOLOGIC HAZARDS

The City of Newport Beach is located along the southwesterly edge of the Los Angeles basin adjacent to the Pacific Ocean. The City will be affected by both regional and local geologic hazards resulting from events that will occur as a result of geologic processes. The purpose of this section is to identify those hazards that will effect the City of Newport Beach. Appendices A through D relate to geologic hazards identified within this section and are attached.

Seismicity

The potential for severe damage and loss of life resulting from earthquake activity exists within the City of Newport Beach as it does throughout Southern California. The City could be faced with several major seismic hazards, such as 1) Ground Shaking, 2) Ground Failure, 3) Ground Displacement 4) Tsunamis and 5) Seiches. The potential hazard from tsunamis and seiches are discussed as a part of Section 2 of this Element. The following discussion of seismic hazards from the "Planners Guide to the Seismic Safety Element", prepared by the Association of Engineering Geologists describes the remaining aforementioned potential hazards:

> "Experience has shown that in most areas of the world, including California, fault movements during historic time have nearly always occurred on already existing faults with evidence of geologically recent movement. Since earthquakes are the result of movement along faults, in attempting to predict future earthquakes and fault movement within - or near - a particular site, consideration should be given not only to the seismic record during historic time, but also to the presence of any faults with evidence of geologically recent movement.
>
> The most widespread effect of an earthquake is <u>ground shaking</u>. This is also usually (but not always) the greatest cause of damage. Structures of all

types, including engineered structures and public utility facilities, if inadequately constructed or designed to withstand the shaking force, may suffer severe damage or collapse. The vast majority of deaths during earthquakes are the result of structural failure due to ground shaking. Most such deaths are preventable, even with present knowledge. New construction can and should be designed and built to withstand probable shaking without collapse. The greatest existing hazard within the state is the continued use of tens of thousands of older structures incapable of withstanding earthquake forces. Knowledge of earthquake-resistant design and construction has increased greatly in recent years, though much remains to be learned.

A second effect of earthquakes is ground failure in the form of landslides, rock falls, subsidence, and other surface and near surface ground movements. This often results in complete loss of strength of water-saturated sub surface foundation soil ("liquefaction") such as occurred near the Juvenile Hall in the 1971 San Fernando earthquake and in the massive Turnagain Arm landslide in Anchorage during the 1964 Alaska earthquake. Most such hazardous sites can be either avoided or stabilized if adequate geologic and soil investigations are utilized.

Another damaging effect of earthquakes is ground displacement (surface rupture) along faults. Such displacements of the earth's crust may be vertical, horizontal, or both and may offset the ground by as much as 30 feet (as in 1857 in Southern California). It is not economically feasible to design and build foundations of structures (dams, buildings, bridges) to remain intact across such zones. Fault zones subject to displacement are best avoided in construction. In addition to regional investigations necessary to the basic understanding of faults and their histories, detailed site investigations are needed prior to the approval of construction in any suspected active fault zones. Utilities, roads, canals, and other linear features are particularly vulnerable to damage as a result of ground displacement."

A seismic hazard map indicating the general locations and extent of areas subject to seismic hazards in Newport Beach is attached (Figure 1). A more detailed preliminary analysis is provided in the "Geologic-Seismic Study" prepared for the City by Woodward-McNeill and Associates.

ACTIVE FAULTS IN SOUTHERN CALIFORNIA

Numerous definitions for active faults have been proposed. Probably the most encompassing definition is that of the California Council on Intergovernmental Relations in the General Plan Guidelines, September 1973, which is:

> "(Active Fault): A fault that has moved in recent geologic time and which is likely to move again in the relatively near future. For geologic purposes, there are no precise limits to recency of movement or probable future movement that define an 'active fault'. Definitions for planning purposes extend on the order of 10,000 years or more back and 100 years or more forward. The exact time limits for planning purposes are usually defined in relation to contemplated uses and structures."

This definition is used in this section for classifying the faults described in alphabetical order, as follows:

Newport-Inglewood Fault Zone:

The Newport-Inglewood Fault Zone is a series of an echelon northwest-trending, vertically-dipping faults extending from the southern edge of the Santa Monica Mountains southeastward to the offshore area near Newport Beach. From north to south the fault segments are: 1) Charnock Fault; 2) Overland Avenue Fault; 3) Inglewood Fault; 4) Potrero Fault; 5) Avalon-Compton Fault; 6) Cherry Hill Fault; and 7) Seal Beach Fault. Numerous recent shocks of 4.0 magnitude or greater, as well as the historic 6.3 magnitude Long Beach Earthquake in March 1933, have been generated within this fault zone and suggest an active seismic history. Although there has been no observed ground surface displacement associated with the Newport-Inglewood Fault Zone, there may have been subsurface fault displacement of approximately seven inches associated with the October 21, 1941, earthquake (magnitude 4.9) and the June 18, 1944, earthquake

(magnitude 4.5). This fault zone could generate a 7.0± magnitude maximum credible earthquake. This is the only active fault within or immediately adjacent to the City of Newport Beach.

Norwalk Fault:

The Norwalk Fault is suggested to be a high-angle reverse fault (Appendix A-3) dipping to the north. The fault is approximately 16 miles long, roughly trending northwest, and has an arcuate trace between Buena Park and Tustin. Microseismic activity along the Norwalk Fault is high and a 4.7 magnitude earthquake occurred on July 8, 1929, which caused significant damage in Whittier and Norwalk. Richter (1958) suggests that the fault may be capable of generating a 6.3 earthquake.

Raymond Fault Zone:

The northeast-southwest trending Raymond Fault Zone has a length of approximately 16 miles and extends from the foothills of the San Gabriel Mountains in Sierra Madre to the Adams Hill area of Glendale. The fault serves as a ground water barrier and is coincident with an obvious topographic scarp along much of its extent through Pasadena. Geologic evidence suggests there has been a minimum of 222 feet of vertical displacement along a portion of the fault near Raymond Hill since Miocene time, and that clay gouge along the fault within the alluvium serves as an aguiclude. Age dating of soil material which fills cracks probably caused by the latest movement of this fault suggests that the fault moved approximately 3,000 years ago. The maximum credible earthquake expected from the Raymond Fault is magnitude 6.8.

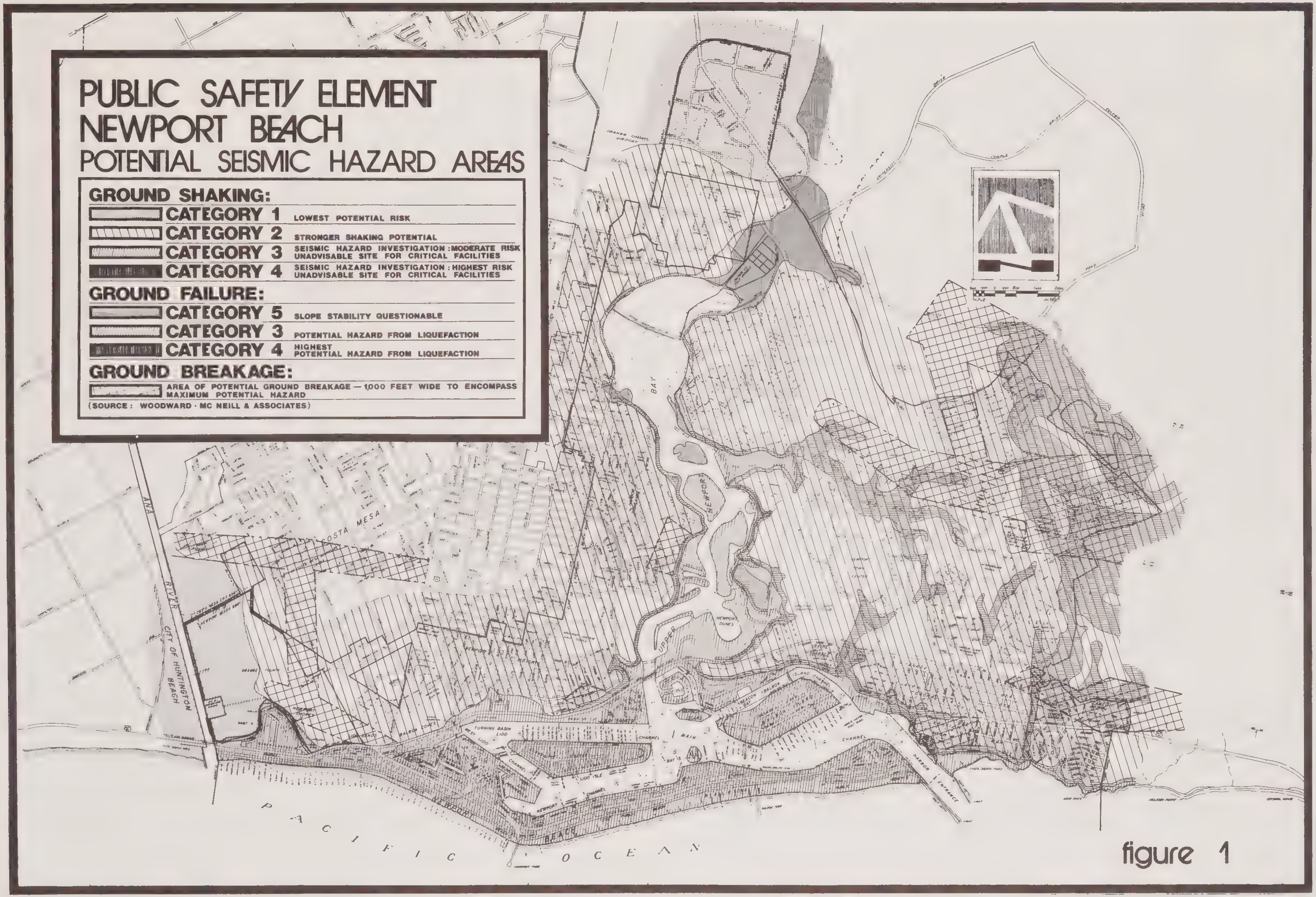

PUBLIC SAFETY ELEMENT
NEWPORT BEACH
POTENTIAL SEISMIC HAZARD AREAS
GROUND SHAKING:
CATEGORY 1 LOWEST POTENTIAL RISK
CATEGORY 2 STRONGER SHAKING POTENTIAL
CATEGORY 3 SEISMIC HAZARD INVESTIGATION : MODERATE RISK UNADVISABLE SITE FOR CRITICAL FACILITIES
CATEGORY 4 SEISMIC HAZARD INVESTIGATION : HIGHEST RISK UNADVISABLE SITE FOR CRITICAL FACILITIES
GROUND FAILURE:
CATEGORY 5 SLOPE STABILITY QUESTIONABLE
CATEGORY 3 POTENTIAL HAZARD FROM LIQUEFACTION
CATEGORY 4 HIGHEST POTENTIAL HAZARD FROM LIQUEFACTION
GROUND BREAKAGE:
AREA OF POTENTIAL GROUND BREAKAGE — 1,000 FEET WIDE TO ENCOMPASS MAXIMUM POTENTIAL HAZARD
(SOURCE : WOODWARD · MC NEILL & ASSOCIATES)
COSTA MESA
SANTA ANA RIVER
CITY OF HUNTINGTON BEACH
UPPER NEWPORT BAY
NEWPORT DUNES
TURNING BASIN
LIDO
CHANNEL
MAIN
HARBOR ENTRANCE
NEWPORT BEACH
PACIFIC OCEAN

figure 1

San Andreas Fault Zone:

The San Andreas Fault Zone extends from the Gulf of California northward to the Cape Mendocino area where it continues northward along the ocean floor. The fault plain is essentially vertical and has a right lateral sense of movement. The total length of the San Andreas Fault Zone is approximately 750 miles. In 1857, a magnitude 8.0^{+}_{-} earthquake occurred along a 225-mile length of this fault between Cholame and San Bernardino. This seismic event is the most significant historic earthquake in Southern California history. The length of this right lateral fault and its active seismic history indicates that it has a very high potential for large-scale movement in the near future (magnitude 8.0^{+}_{-}), and should be considered important in land-use planning for most cities in California.

San Fernando Fault Zone:

Fault segments that were demonstrably involved in the February 9, 1971, San Fernando Earthquake (magnitude 6.4) are, for the most part, east-west trending thrust faults with associated left lateral movement. The ground surface ruptures occurred on little known pre-existing faults in an area of low seismicity and previously unknown historic ground displacement. The zone of displacement was approximately 12 miles long and had a maximum of three feet vertical movement. The fault plane dips northward at an angle of approximately 55 degrees from the horizontal. The earthquake epicenter of the February 9, 1971, seismic event was near the community of Newhall. The recurrence interval for the San Fernando Fault Zone is estimated to be approximately 200 years. The Santa Susana Thrust extends westward from the area of the San Fernando Fault Zone. This

thrust has been classified as potentially active by some geologists based on evidence which suggests that movement has occurred within the past two million years. In its western portions, there is evidence that the fault plane has been folded and would therefore probably not have renewed movement.

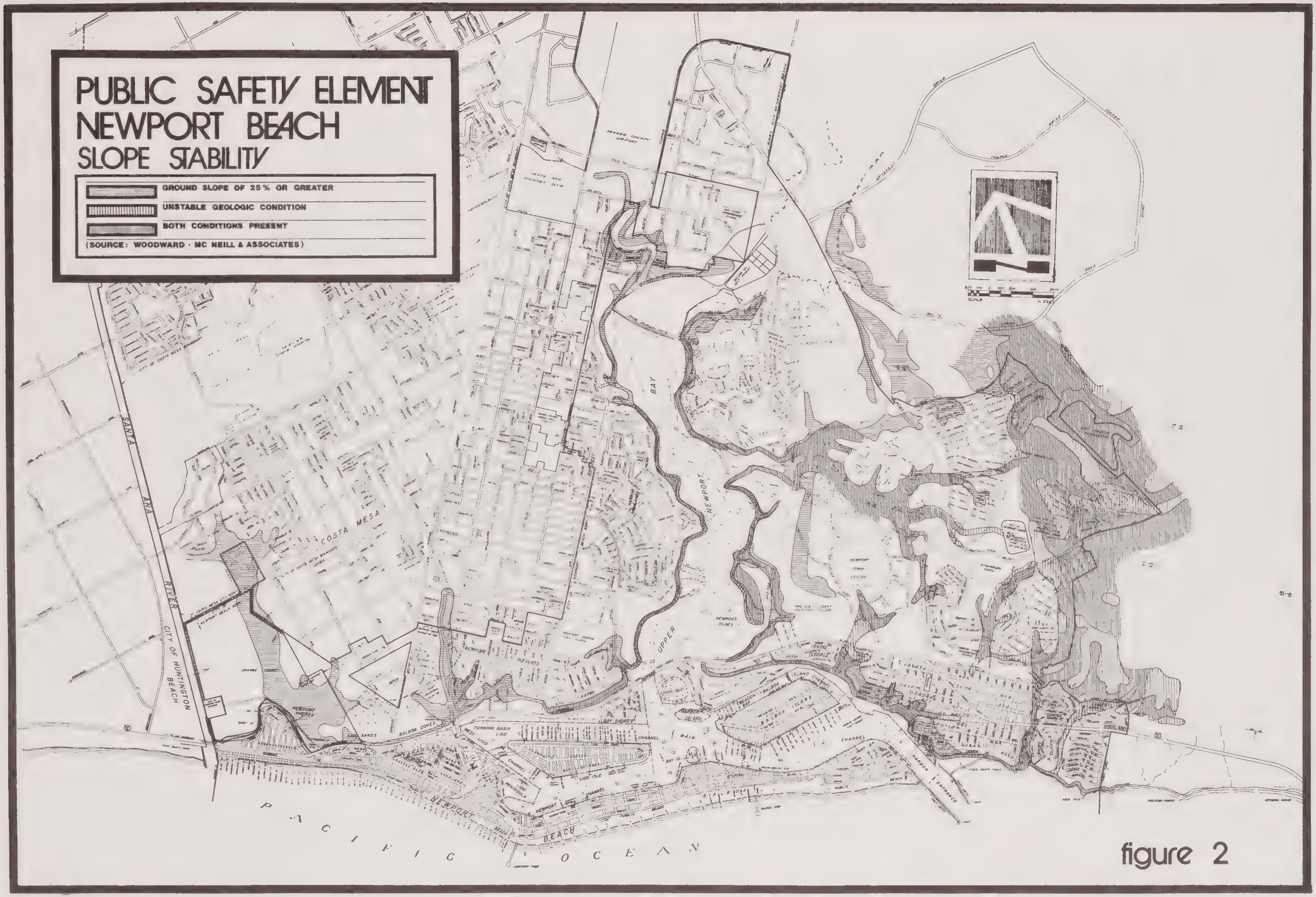
San Jacinto Fault:

The San Jacinto Fault is a northwest-trending complex series of right-lateral faults extending from the eastern San Gabriel Mountains south through the Borrego Valley. This fault appears to merge with the San Andreas Fault southeast of Pearblossom. Seismically one of the most active faults in the state, the San Jacinto has been the origin of many small and moderately large historic earthquake shocks. Ground surface displacement has occurred along the fault, the most recent being in Borrego Valley in San Diego and Imperial Counties on April 8, 1968, during a magnitude 6.5 earthquake.

Slope Stability

The stability of slopes is an important planning consideration for existing and future development within the City. Slope failures either gross or superficial can result in a potential hazard to life and limb, or endanger public and private property. The types of slope failures that may occur within the community will probably be, 1) landslides, 2) mud flows, 3) creep and in some cases 4) rock fall. (See definitions in Appendix D). In any planning consideration, the more important factors are generally, the inherent strength of the earth material of which the geologic formations are comprised, the moisure content of these materials, and the attitude of the bedding within the materials.

Within the Newport Beach planning area and land adjacent to it, the areas of low slope stability include areas in the San Joaquin hills and the bluff areas throughout the City. As shown on Figure 2, these areas of low slope staiblity occur primarily in areas of moderate to steeply-sloping terrain.


PUBLIC SAFETY ELEMENT
NEWPORT BEACH
SLOPE STABILITY
GROUND SLOPE OF 25% OR GREATER
UNSTABLE GEOLOGIC CONDITION
BOTH CONDITIONS PRESENT
(SOURCE: WOODWARD - MC NEILL & ASSOCIATES)
COSTA MESA
SANTA ANA RIVER
CITY OF HUNTINGTON BEACH
UPPER NEWPORT BAY
NEWPORT BEACH
PACIFIC OCEAN
LIDO ISLE
BALBOA ISLAND
TURNING BASIN
MAIN CHANNEL
HARBOR ENTRANCE
IRVINE TERRACE
ORANGE COUNTY AIRPORT
figure 2

Expansive and Collapsible Soil

Expansive soils are generally defined as those soils that exhibit a change in volume when the moisture content of the soil is varied. The degree of expansion is most generally related to the magnitude of this change and expressed as ranging from very low to very high. A collapsible soil is usually considered as a loosely packed or open structured soil that exhibits a sudden loss of volume upon the addition of a significant quantity of water.

Expansive and collapsible soils usually have an adverse effect on building foundations often resulting in negative impacts on the entire structure.

Movements may vary under different parts of a building with the result that the foundations crack, with vertical displacement, causing various structural portions of the building to be destroyed. In the extreme case windows and doors are warped so that they do not function properly, rendering the building useless for its intended occupancy. These problems can be identified and controlled by proper engineering and construction practices. Figure 3 divides the City into categories of expansive soil probabilities.

Collapsible soils are not prevalent within the City; however, they do occur locally, and should be addressed on a project-by-project level by all geotechnical studies conducted within the City.

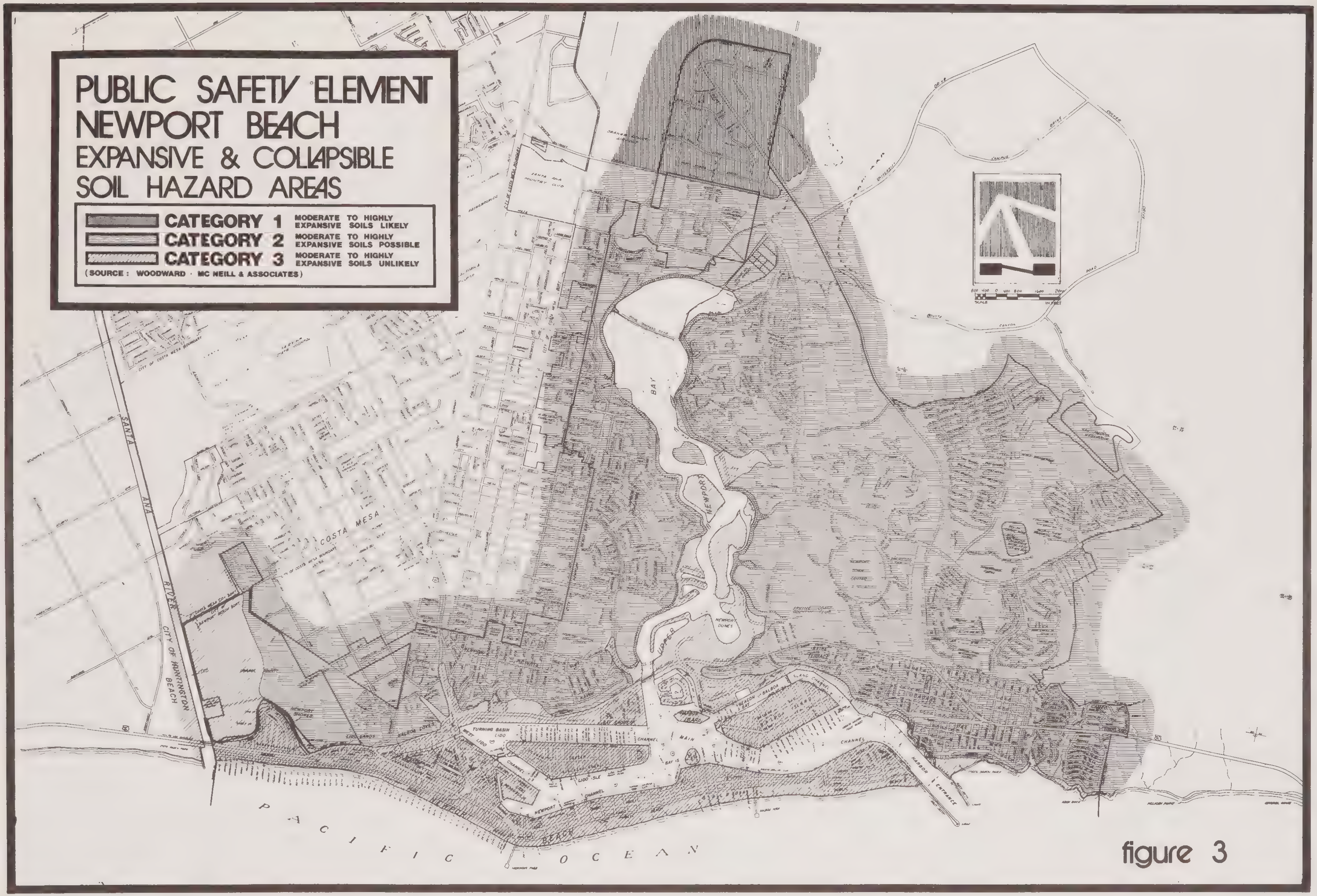

PUBLIC SAFETY ELEMENT
NEWPORT BEACH
EXPANSIVE & COLLAPSIBLE
SOIL HAZARD AREAS
CATEGORY 1 MODERATE TO HIGHLY EXPANSIVE SOILS LIKELY
CATEGORY 2 MODERATE TO HIGHLY EXPANSIVE SOILS POSSIBLE
CATEGORY 3 MODERATE TO HIGHLY EXPANSIVE SOILS UNLIKELY
(SOURCE: WOODWARD · MC NEILL & ASSOCIATES)
SANTA ANA RIVER
CITY OF HUNTINGTON BEACH
COSTA MESA
UPPER NEWPORT BAY
NEWPORT BEACH
PACIFIC OCEAN

figure 3

Erosion and Siltation

Soil erosion occurs as a result of the action of wind and water and is a geologic process commonly referred to as mass wasting. While wind erosion may have some localized significance, it is not a major natural hazard.

Erosion as a result of running water is an acute potential risk within the City, especially during periods of heavy rainfall and runoff. The erosion of soils can undermine structures or damage slopes and could result in property damage and/or the loss of life and limb.

Siltation resulting from the deposition of eroded earth materials also presents an acute potential risk. Due to the City's geographic locations, regional as well as local siltation should be considered as a part of this hazard. Inundation of structures both public and private can reduce the capacities of drainage structures and, thereby reduce capacities for flow and storage of flood waters.

Erosion and subsequent siltation are magnified during new construction where the removal of natural ground cover occurs.

Periodic dredging of Newport Bay has been required to remove depositions of silt resulting from erosion occurring principally outside of the City. The majority of this silt enters the bay through San Diego Creek and comes from erosion within that creek's watershed.

Figure 4 indicates the general locations of potential erosion and siltation-related problems.

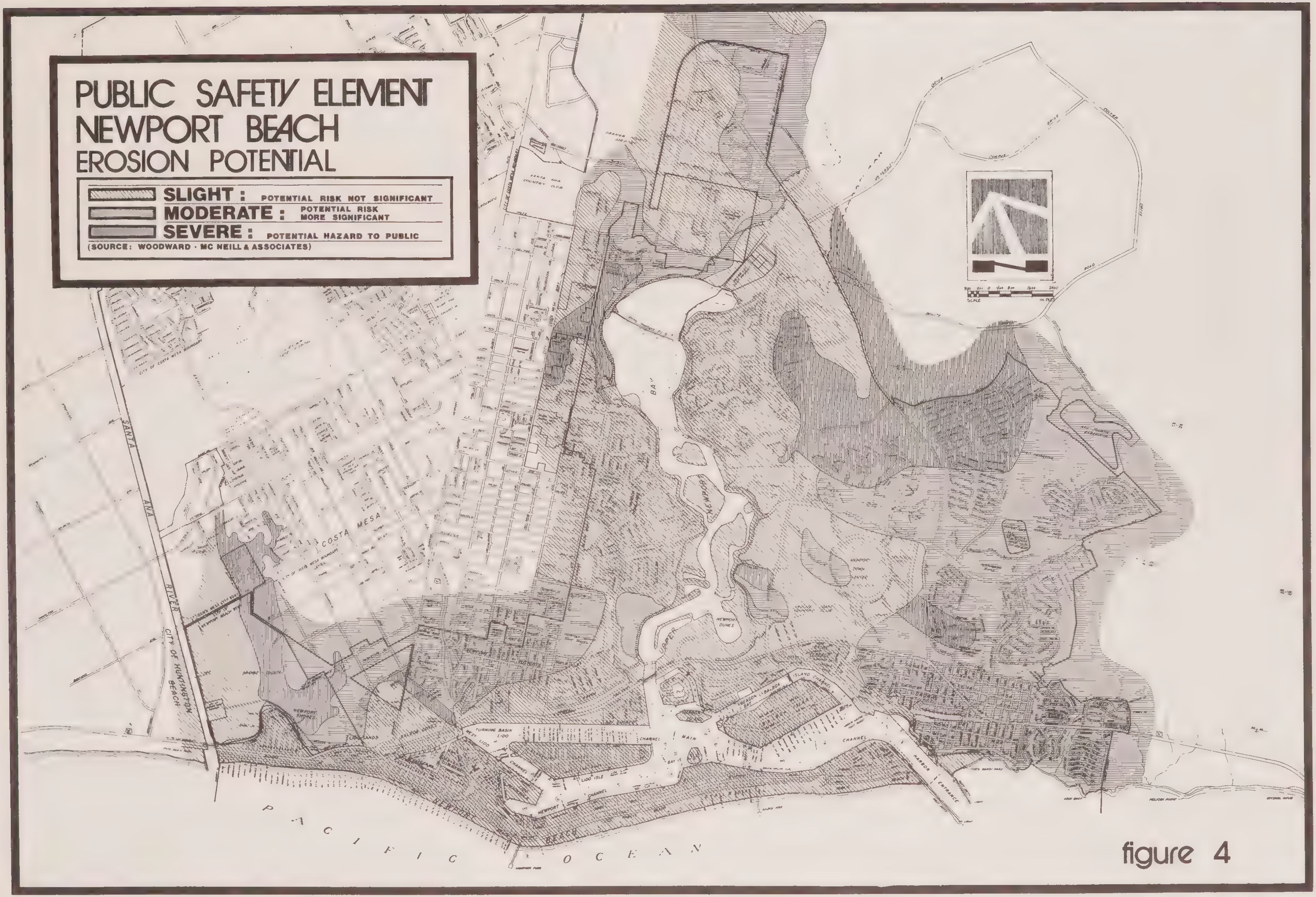

PUBLIC SAFETY ELEMENT
NEWPORT BEACH
EROSION POTENTIAL
SLIGHT : POTENTIAL RISK NOT SIGNIFICANT
MODERATE : POTENTIAL RISK MORE SIGNIFICANT
SEVERE : POTENTIAL HAZARD TO PUBLIC
(SOURCE: WOODWARD · MC NEILL & ASSOCIATES)
COSTA MESA
SANTA ANA RIVER
CITY OF HUNTINGTON BEACH
BAY
NEWPORT DUNES
TURNING BASIN
WEST LIDO
LIDO ISLE
CHANNEL
MAIN
ISLAND CHANNEL
HARBOR ENTRANCE
NEWPORT BEACH
PACIFIC OCEAN

figure 4

Excessive Settlement and Subsidence

With the exception of areas adjacent to the Upper Bay, soils within the Newport Beach planning area are generally considered to be not compressible and, therefore, not subject to excessive settlement. In Big Canyon and in the northeasterly portion of the Upper Bay lowlands, soft, compressible silts and clays are prevalent. The introduction of fill materials and development of these areas could result in excessive settlement and damage to structures.

Subsidence is a local mass movement of earth materials which are displaced vertically downward causing large-area settlements. In the Woodward-McNeill study, no areas of significant subsidence problems were identified within the Newport Beach planning area.

Summation

Geologic hazards require identification and evaluation by qualified professionals if they are to be delt with satisfactorily. As a first step in this program, the City retained the firm of Woodward-McNeill and Associates to prepare a preliminary "Geologic-Seismic Study" of Newport Beach.

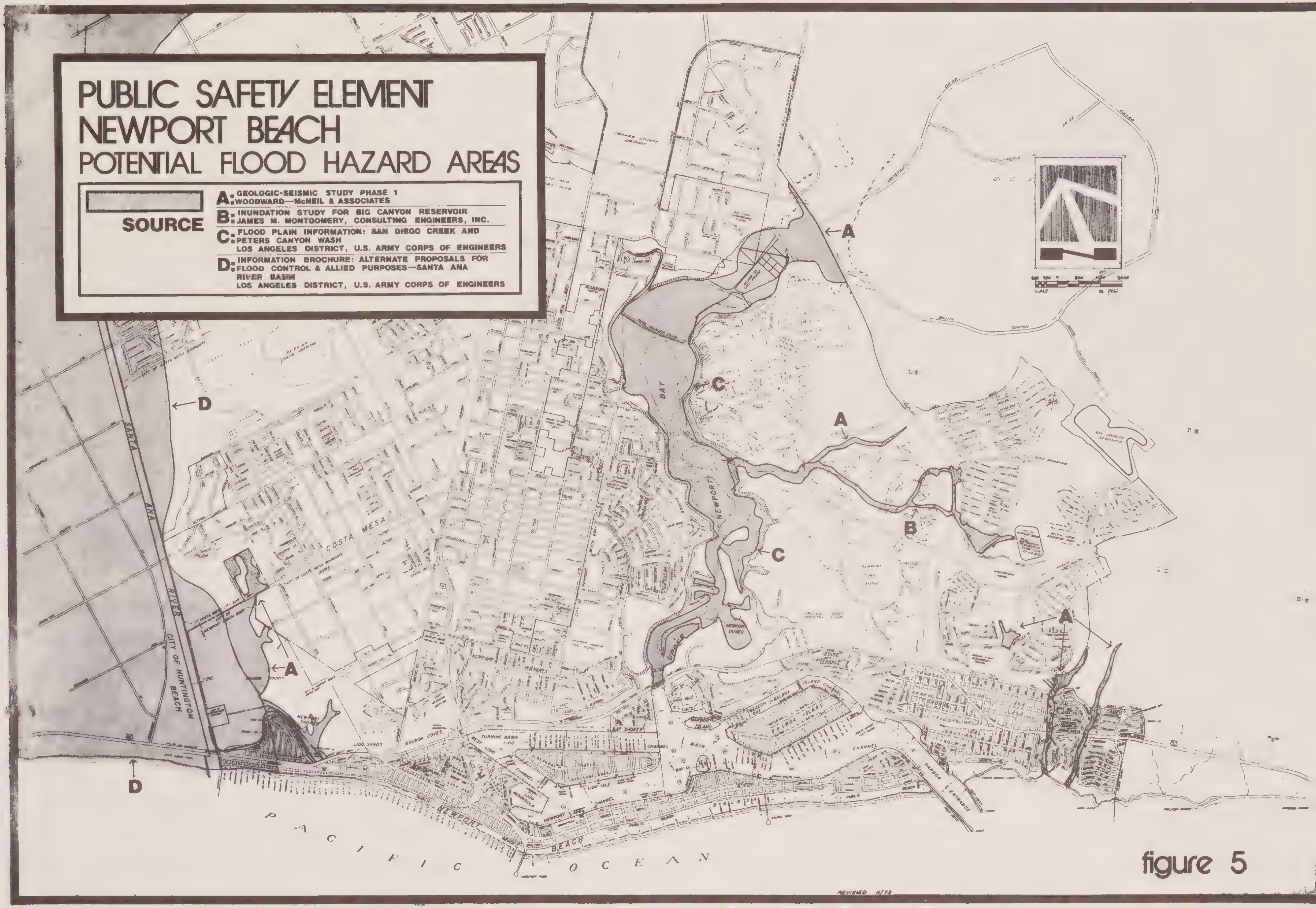
The County of Orange in cooperation with the California Division of Mines and Geology has been preparing a series of Geologic maps for the entire county based on the most recent data available. Subsequent to its publication, the City will incorporate and utilize this data as required to update our existing code enforcement relating to geologic hazards.

SECTION 2 - FLOOD HAZARD

Flooding has been one of the costliest natural hazards in California. National statistics have shown this state ranking as one of the major flood problem areas within the nation. Flooding in the Newport Beach planning area though has not historically been as severe a problem as it has within other local jurisdictions.

This section of the Public Safety Element delineates (Figure 5) flood-prone areas within the City, and evaluates the potential public safety hazard. This Element deals only with areas of potential major damage from a severe storm. Localized instances of innundation, such as that which occurs in the low-lying areas of the City during more normal storms or high tides, will not be addressed.

Policies directed toward achieving an acceptable "level of risk" to the public from innundation are included as a part of the "Risk Reduction Programs" located in the last portion of this Element.



PUBLIC SAFETY ELEMENT
NEWPORT BEACH
POTENTIAL FLOOD HAZARD AREAS
SOURCE
A: GEOLOGIC-SEISMIC STUDY PHASE 1 WOODWARD—McNEIL & ASSOCIATES
B: INUNDATION STUDY FOR BIG CANYON RESERVOIR JAMES M. MONTGOMERY, CONSULTING ENGINEERS, INC.
C: FLOOD PLAIN INFORMATION: SAN DIEGO CREEK AND PETERS CANYON WASH LOS ANGELES DISTRICT, U.S. ARMY CORPS OF ENGINEERS
D: INFORMATION BROCHURE: ALTERNATE PROPOSALS FOR FLOOD CONTROL & ALLIED PURPOSES—SANTA ANA RIVER BASIN LOS ANGELES DISTRICT, U.S. ARMY CORPS OF ENGINEERS
A
B
C
D
SANTA ANA RIVER
CITY OF HUNTINGTON BEACH
COSTA MESA
NEWPORT BAY
UPPER
BALBOA COVES
LIDO SANDS
LIDO ISLE
BALBOA ISLAND
NEWPORT BEACH
PACIFIC OCEAN
REVISED 11/78

figure 5

Santa Ana River Area

The potential for loss due to flooding is greatest in the low-lying area immediately adjacent to the Santa Ana River. During the 1969 storms of January and February (35-year flood)the river's waters came close to approaching the capacities of protection measures. Considerable pollution of the beach and river itself occurred.

The Santa Ana River drains approximately 3,200 square miles in San Bernardino, Orange, and Riverside Counties. Obviously, the risk from flood damage due to the river overflowing is beyond the ability of Newport Beach to control.

A recent study by the United States Army Corps of Engineers has indicated that the risk along the Santa Ana River can be lessened through several corrective measures upstream. The actual disposition of this study and the protective measures to be used are still unresolved. Until adequate measures are taken upstream, the risk will remain in Newport Beach. The construction of the major corrective measures presented in the Army Corps of Engineer's study, if approved, would commence in 1980, with completion taking eight to ten years.

San Diego Creek

The San Diego Creek Watershed encompasses approximately 118 square miles of Orange County draining southwest to Upper Newport Bay. The Creek has historically been the cause of considerable flood damage. The 1969 storm's damage along this creek included the washing out of MacArthur Boulevard with associated damage to adjacent roads and agricultural areas, and the deposition of massive amounts of silt into the Upper Bay.

The construction of facilities for the off-ramps of the Corona del Mar freeway and MacArthur Boulevard interchange should eliminate the potential flood risk in terms of the highway.

The low-lying lands adjacent to the San Diego Creek and the Upper Bay will continue to be flood-prone areas.

Delhi Channel Area

This channel area is located at the northwest edge of the Upper Bay. A potential for flood damage within the area was identified by Woodward-McNeil and Associates in 1971. The United States Army Corps of Engineers confirmed this finding in 1972 ("Flood Plain Information -- San Diego Creek and Peters Canyon Wash"). Currently the Land Use and Open Space Elements indicate this area for open space uses.

Buck Gully, Morning Canyon and Jasmine Creek

These areas were identified for the City as possible flood risk locations in the 1971 Woodward-McNeill and Associates "Geologic-Seismic Study". For the most part these are areas of natural drainage to the bay or ocean, some of which have been improved through public or private projects.

All of these locations have been designated on the Land Use Element of the General Plan for "Recreational and Environmental Open Space".

Big Canyon Reservoir

In order to fulfill State requirements a detailed inundation study was prepared by James M. Montgomery, Consulting Engineers, Inc., for areas downstream of Big Canyon Reservoir. This was accomplished in order to provide guidance to public safety agencies for the development of safety measures in the event of flooding from a partial or total failure of the dam. This critical reservoir is used to store water for domestic consumption, with the reservoir located within a 1200± acre watershed which drains to Upper Newport Bay. The "Inundation Study for Big Canyon Reservoir -- Orange County, California", indicated the general area of potential risk which is delineated on Figure 5.

Tsunami, Seiche and Storm Surge

In October of 1974 the Coast and Geodetic Survey indicated to the City that shoreline properties and the islands of the Lower Bay were subject to potential flood hazard from storm surge and tsunamis. A tsunami is a sea wave generated by a sub-marine earthquake, major landslide, or volcanic action. These sea waves are long, powerful, low waves which in the open sea create relatively few problems. It is upon their approach to the coastline that tsunamis, because of coastal configurations or bottom topography, can become high waves or strong currents, both of which are capable of causing major damage.

The risk to the public safety of tsunamis resulting from landslides or volcanic action has been evaluated and found to be extremely remote within the City. A Woodward-McNeill and Associates report prepared in 1971 as background information for this Element of the General Plan stated that the City is afforded a degree of protection (from tsunamis) by coastal islands with the chance for major damage to the coastal areas or harbor entrances not great, and negligible for inland bay areas.

In October of 1974 the firm of Moffatt and Nichol, Engineers, under contract with the City, again reviewed the potential hazard to the public safety in Newport Beach from a projected 100-year Tsunami occurrence. Their report, "A Preliminary Study of Flood Probability at Newport Beach" stated that the projected 100-year Tsunami would have less effect than astronomical tides and even the highest of these tides is below bulkhead elevations.

Potential flood hazard from storm surge was also identified as a risk

to the public safety by the Coast and Geodetic Survey. Moffatt and Nichol reviewed this potential occurrence and their report stated:

> "...provided an adequate width beach berm at present day elevations is maintained, large scale inundation of City's ocean-front by storm surge and accompanying waves would not occur.
>
> Furthermore, in the interior waterways, the bulkhead elevation..........provides adequate freeboard for estimated possible storm surges within the Bay."

Based on this information there does not appear to be a flood hazard for either the lower bay or shoreline areas.

A seiche is the oscillation of sloshing of water in an enclosed body of water caused by seismic activity or landsliding. Due to the small surface area of the bodies of water within the City, seiches do not represent a potential hazard to the public safety.

SECTION 3 - FIRE HAZARDS

It is the intent of this section of the Public Safety Element to review undeveloped high fire hazard locations within the Newport Beach planning area. This Element will not deal with fire protection within the developed areas of the City. The Community Facilities Element will address fire stations, their locations, facilities for services, and response times to potential fire risks within urban structures. The undeveloped areas of fire risk, along with existing programs designed to achieve low levels of risk to the public safety, have been identified in this Element with the assistance of the Newport Beach Fire Department.

A majority of the City of Newport Beach has undergone or is in the process of urbanization. Thus, only a limited number of undeveloped fire risk areas remain within the City's planning area, as indicated on Figure 6. Yet, this urbanization introduces people in close proximity to fire hazard areas and results in an increased public safety hazard. This hazard is further increased by the desires of Newport Beach citizens to maintain natural parks and open areas.

The problem of high fire risk from undeveloped areas has a seasonal aspect. While the potential for fire exists throughout the year, the most acute problems of high fire hazard exist in the late summer and fall of every year. It is at this time that grasses, brush, and natural ground cover, which have grown throughout the winter and spring, become dry and volatile. These climatic conditions are often accentuated by very hot-dry

Santa Ana winds which decrease the humidity and increase the potential spread and intensity of local fires. This type of wind condition can cause fires to whip through areas at many times the normal rate.

The probability of natural occurrence of fires within the areas designated by Figure 6 would be evaluated as low and not an acute problem. It is because of the close proximity of residential developments and the introduction of people to these undeveloped areas that risk to the public safety increases. People through carelessness or accident create a majority of damage to natural areas and cause an increase of fire risk from these areas. The problems associated with fire risk locations are accentuated when dwellings with wooden shake roofs and close or limited spacing between units are located in close proximity to fire hazard areas. This has been identified by the Fire Department as historically a problem and one which will remain as long as development patterns, such as this, exist within the City.

Fire Hazard Categories

In Figure 6 three categories of fire risk have been identified for the existing state of development in Newport Beach. The general characteristics of each category vary due to access, type of combustible materials and other associated factors. The factors involved in each rating and control measures are described below.

Category I:

This category indicates locations of probably the highest fire risk within the City. They are characterized as very dry and this condition is accentuated by the fact that these are also very rugged locations. The land within this category is classified as fast propogating natural areas of high fire hazard. In addition this designation generally denotes land in steep sloping terrain that is too rugged to clear with equipment.

Much of the land which falls within Category I is designated as Recreational and Environmental Open Space by the Land Use Element of the General Plan. This is an indication that natural fire risk conditions will continue into the future.

Category II:

This potential high risk fire category has been designated in four areas within the City:

1. Buck Gully
2. Morning Canyon
3. Big Canyon
4. St. James Road area

These four locations are characterized as containing both domestic

and natural vegetation growth. They are generally "greener" than Category I containing more combustible material and are identified as areas which burn readily. Another major factor in so designating these sites is that access to the interior of each is not readily available and not possible through conventional means.

Three of the aforementioned locations (Figure 6) are designated for Recreational and Environmental Open Space by the Land Use Element of the General Plan. The Open Space and Recreation Element further proposes that the canyons as they run through Corona del Mar from the beach to the San Joaquin Hills be maintained as natural open space, by public acquisition of land in fee or by easement. This is an indication that the high fire risk of the present will continue. Future acquisition through either method should be coupled with a sound risk management effort.

Category III:

This category contains a majority of the remaining undeveloped land throughout and adjacent to the City. It is a characteristic of these areas that they are fired more often than either of the previous categories, yet because of their location, they are not deemed to be as potentially hazardous to the public. This is due to a higher containment factor created by access and fire breaks. These high fire hazard areas for the most part are cleaned of cover twice a year by their owners or by contract crews under the direction of the Fire Department.

Fire breaks are also designated on the Fire Hazards Map (Figure 6). These are linear strips where the natural vegetation has been removed or reduced. Several of these fire breaks have been

cut and are maintained by private land owners; others by the Parks, Beaches and Recreation Department or contract crews under the direction of the Fire Department. These fire breaks form an intregal portion of the overall Fire Department risk reduction program.

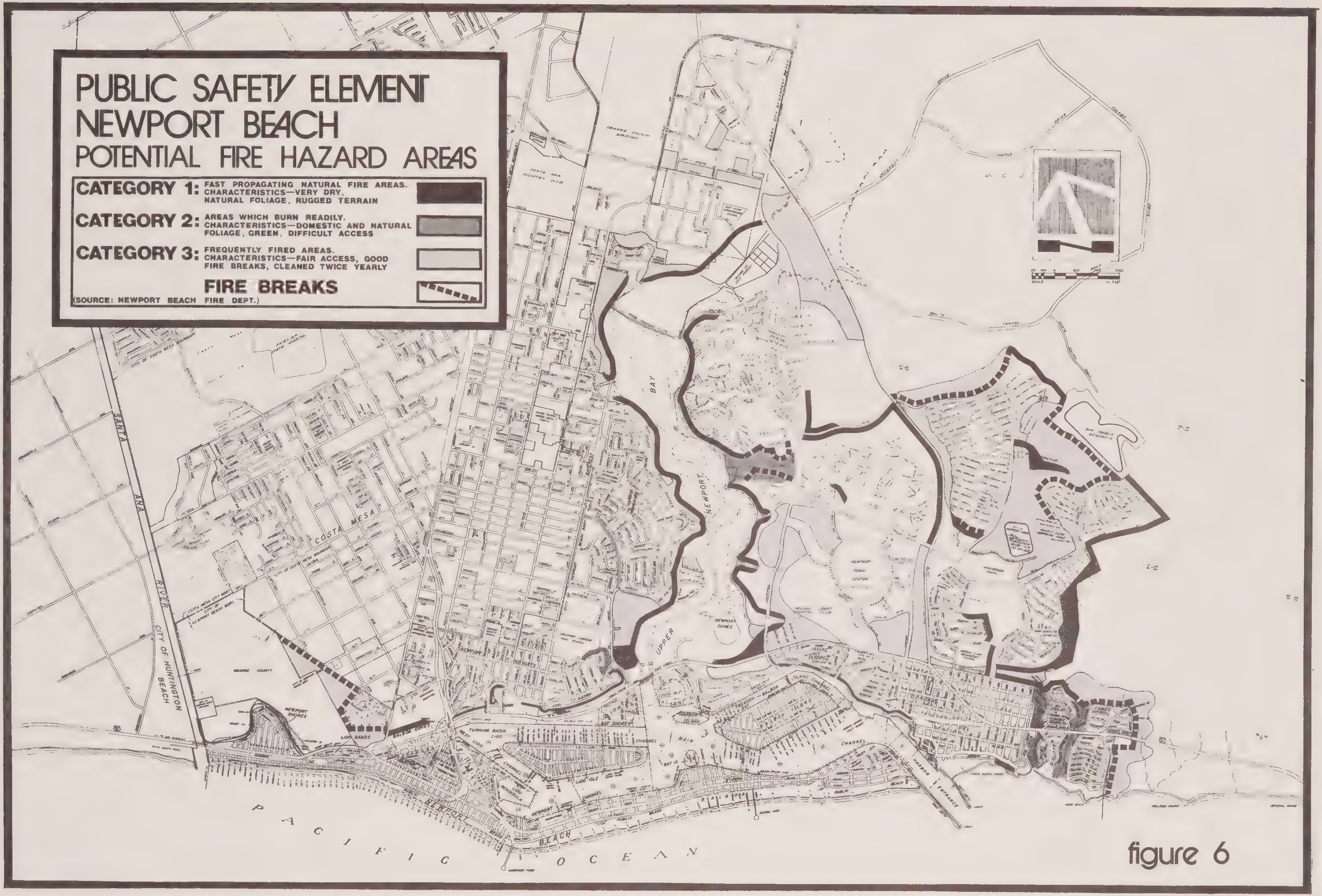

PUBLIC SAFETY ELEMENT
NEWPORT BEACH
POTENTIAL FIRE HAZARD AREAS
CATEGORY 1: FAST PROPAGATING NATURAL FIRE AREAS. CHARACTERISTICS—VERY DRY, NATURAL FOLIAGE, RUGGED TERRAIN
CATEGORY 2: AREAS WHICH BURN READILY. CHARACTERISTICS—DOMESTIC AND NATURAL FOLIAGE, GREEN, DIFFICULT ACCESS
CATEGORY 3: FREQUENTLY FIRED AREAS. CHARACTERISTICS—FAIR ACCESS, GOOD FIRE BREAKS, CLEANED TWICE YEARLY
FIRE BREAKS
(SOURCE: NEWPORT BEACH FIRE DEPT.)
SANTA ANA RIVER
CITY OF HUNTINGTON BEACH
COSTA MESA
UPPER NEWPORT BAY
NEWPORT SHORES
LIDO SANDS
TURNING BASIN
LIDO ISLE
BAY SHORES
BALBOA ISLAND
HARBOR ENTRANCE
NEWPORT BEACH
PACIFIC OCEAN

figure 6

Risk Evaluation and Mitigation

A majority of the areas designated as fire risk locations are planned for urbanization within the framework of the General Plan. Several locations, though, previously mentioned, are slated to remain in a natural state for environmental or aesthetic reasons.

It is because of the intensity of development adjacent to Categories I and II and problems associated with and within these areas, that potential loss is greatest. Loss in these areas could include the vegetation cover and structures adjacent to these areas. Without plans for replanting in case of fire occurrence the potential for soil erosion exists subsequent to an area being fired.

The potential loss in Category III is lower, due to: 1) the natural cover in these areas being of a lesser nature, and 2) the ability of public services to address the problem being greater through existing programs and access.

The City's Fire Department and Parks, Beaches and Recreation Department provide for risk mitigation measures in primarily two forms: 1) physical action measures, and 2) educational programs.

The City is involved in primarily two physical action programs intent on removal or lessening of combustible material on a particular site. Involved in this are twice-yearly removals of brush through a weed abatement program. The other is the development of operational fire breaks stragetically located throughout the City (Figure 6).

The City is also involved in educational programs, most notably the Junior Fireman Program. This effort is aimed toward elementary school children throughout the City. The dual goal of this program is to establish rapport with the children and improve the understanding of school age children of both the Fire Department and potential fire problems. In addition to this, the Fire Department also addresses local groups on fire-associated problems within the City.

DISASTER PLANNING

The City of Newport Beach has an adopted Emergency Operations Plan which is currently being reviewed by appropriate State agencies. This portion of the Element will evaluate this emergency plan in terms of the existing and future physical development of the City and the natural physical hazards identified in the previous sections of this Element.

Emergency Operations Plan

The adopted Newport Beach Emergency Operations Plan was prepared in accordance with Federal, State and County guidelines, and developed to meet the particular needs of the community. Primarily the plan provides for emergency operations for two types of occurrences, these being civil emergencies and natural disasters. As this Element addresses safety in terms of physical development, no attempt has been made to review plan proposals for civil emergencies.

The Emergency Operations Plan provides Newport Beach with a basic framework for reaction to disasters in terms of authority, responsibilities, and location of critical facilities and services. The purpose of the plan is stated as follows:

> "1. Provide a basis for the conduct and coordination of operations and the management of critical resources during emergencies;
>
> 2. Establish a mutual understanding of the authority, responsibilities, functions, and operations of civil government during emergencies;
>
> 3. Provide a basis for incorporating into the city emergency organization non-governmental agencies and organizations having resources necessary to meet foreseeable emergency requirements."

The Emergency Operations Plan recognizes that the impact of earthquake, fire, and flood grows larger as areas of high-risk land are

used to keep up with urban growth. Any of the aforementioned natural occurrences would tax the resources of a single governmental entity; therefore, inter-jurisdictional mutual-aid programs are provided for. As adopted, the Newport Beach Emergency Operations Plan prepares for, and conducts operations in order to accomplish the following objectives:

1. Provide for the continuity of government.
2. Provide a basis for direction and control of emergency operations.
3. Save lives and protect property.
4. Repair and restore essential systems and services.
5. Provide for the protection use, and distribution of remaining resources.
6. Coordinate operations with the civil defense-emergency service organizations of other jurisdictions.

In some of the emergency situations discussed previously, as natural hazards to the public safety, the potential loss from the occurrence of hazards can be substantially reduced through an effective warning system coupled with effective evacuation procedures. Tsunamis and potential flooding from the Santa Ana River are examples of risks where there will be an advance warning. Other emergencies potentially could occur without advance warning, thus requiring mobilization and commitment of emergency organization after the onset of the occurrence.

Evacuation Routes:

Evacuation route analysis is not a part of the Emergency Operations Plan. For the most part, the plan addresses civil emergencies and not natural occurrences in terms of evacuation routes. The Chief of Police is responsible for traffic control services.

The value of a potential evacuation route is dependent on several factors; among these are: 1) the type of hazard occurrence, 2) the degree of severity and the location of the occurrence, and 3) the mode of evacuation. Generally, the older areas of the City have the highest degree of potential problem during an evacuation. The harbor islands, portions of the Balboa Peninsula, the West Newport Area, Cameo Highland and Cameo Shores have single access to major evacuation routes. This problem is further accentuated by the desirability of many of these areas for public recreation. Figure 7, which follows, delineates these potential problems. The Master Plan of Streets and Highways indicates several future projects such as the new bay bridge and the realignment of Pacific Coast Highway in West Newport which will improve existing conditions.

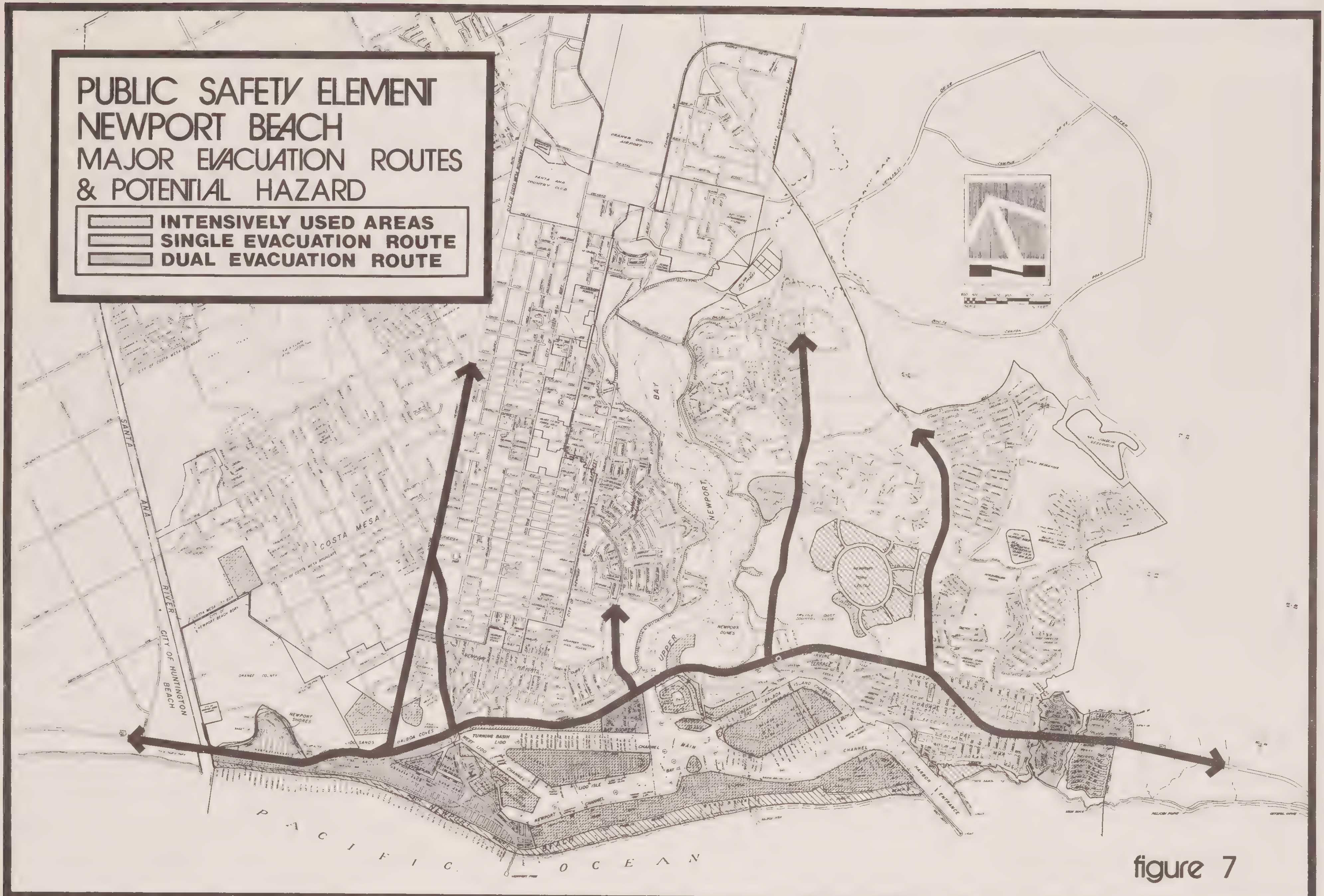

PUBLIC SAFETY ELEMENT
NEWPORT BEACH
MAJOR EVACUATION ROUTES
& POTENTIAL HAZARD
INTENSIVELY USED AREAS
SINGLE EVACUATION ROUTE
DUAL EVACUATION ROUTE
COSTA MESA
SANTA ANA RIVER
CITY OF HUNTINGTON BEACH
NEWPORT SHORES
BALBOA COVES
TURNING BASIN
UPPER NEWPORT BAY
PACIFIC OCEAN

figure 7

RISK REDUCTION PROGRAM

A hazard free environment does not exist. Natural and/or man-made hazards of some kind or degree are and will always be present. The preceding sections of this Element have attempted to identify, delineate, and evaluate risks from natural hazards, along with an evaluation of risk mitigation measures currently in effect.

The guidelines for the preparation of both the Seismic Safety and Safety Elements (combined in this Element) prepared by the California Council on Intergovernmental Relations suggest that each local jurisdiction go beyond the aforementioned to define an "acceptable level of risk" for its citizenry. The thought of an <u>acceptable</u> risk is alien to many people. The natural reaction is to state that <u>no</u> risk is acceptable, yet every day, through the course of normal actions, people expose themselves to risks at a variety of levels. These are risks willingly taken such as driving, that people take to derive benefits. Such a risk can be mitigated by rules, regulations, and safety equipment.

The acceptability of a risk by the general public is dependent on the nature of the risk. People generally are more willing to accept higher risk from situations such as driving that they wish to engage in. There are three major risks to the public safety which served as critieria for establishing priority action areas:

1. Injuries and loss of life
2. Damage to property
3. Economic and social dislocation.

The risk to the public from societal disruption such as the long-term impacts of a major earthquake cannot be adequately dealt with at the local level and must be addressed by regional, state and federal agencies.

The primary concern of the Public Safety Element and the City of Newport Beach is in terms of risks to person and personal property. In the context of the Public Safety Element, the problem of risk is one of public policy and the appropriate allocation of resources to mitigate potential hazards. The basic premise of this Element has been to provide for safety considerations in plans for the physical development of Newport Beach. Toward this end areas of critical concern are listed below:

Geologic Hazards

.High occupancy earthquake hazardous old buildings
.Medium- and high-rise buildings
.Concentrations of dependent populations
.Vital facilities
.Seismic unsafe public and quasi-public facilities
.Disaster response
.Low occupancy earthquake hazardous buildings
.School earthquake safety programs

Flood Hazards

.Developed areas of potential inundation
.Undeveloped areas of potential inundation
.Flood insurance education programs

Fire Hazards

.High natural fire hazard areas
.Weed and brush abatement programs
.School education programs

It is through the adoption and implementation of this Public Safety Element that Newport Beach establishes the level of risk it deems as acceptable.

The following "Risk Reduction Program" is intended to provide the maximum reasonable mitigation of natural physical hazards to life and property in Newport Beach.

Risk Reduction Program

General:

1. The City shall require Environmental Impact Reports for any development within areas of natural physical hazard, as defined in this Element; said E.I.R.'s to include detailed assessment of the hazards and a comprehensive mitigation program.
2. The City shall require complete studies of the siting and construction of emergency/critical facilities; new emergency/critical facilities shall not be constructed in areas of high natural physical hazards.
3. The City shall support the development concept of clustering structures and facilities in favorable areas, restricting development in steeply-sloping topography, on bluff edges, erodible areas, and other areas of high natural-physical hazard.

Geologic Hazards:

1. The City shall adopt a new grading ordinance, including more-stringent erosion and siltation control and geologic hazard mitigation requirements.
2. The City shall require geologic and seismic studies as an integral portion of all Environmental Impact Reports with detailed mitigation measures for any development in areas of high potential hazards.
3. The City shall critically review proposals for development in expansive and collapsible soils and will require detailed geotechnical studies prior to development to assure mitigation of risk.

4. The City shall require building siting and design to be compensatory with geologic hazards which reflect varying requirements based on risk, location and type of occupancy, and shall be safe and stable for its intended use.
5. The City shall encourage and participate in future studies of faults and seismic hazards to provide more-detailed technical information.

Fire Hazards from Undeveloped Areas

1. The City shall support existing Fire Department programs such as the weed abatement program which reduces risk from high fire hazard areas.
2. The City shall require the use of fire retardant roofing materials adjacent to high fire hazard areas.
3. The City shall continue to support the Junior Fireman Program and other public information activities of the Fire Department so as to lessen fire risk through citizen education and awareness.

Flood Hazards

1. The City shall investigate the establishment of standards and criteria for development in flood-prone areas which would fulfill federal requirements, yet maintain the character of each existing Newport Beach village.
2. The City shall endeavor to restrict future development in areas of high flood hazard until it can be shown that the risk is or can be mitigated.
3. The City shall support regional planning efforts toward the control of flood risk from the Santa Ana River and San Diego Creek by monitoring existing programs and when appropriate joining in the endeavors of various

jurisdictions to lessen potential flood hazard.

4. The City shall prepare a flood plain management program for areas subject to inundation from major rivers, streams, and creeks which may include:
   A. The application of Planned Community zoning to allow for clustering of buildings and density transfer so as to permit utilization of flood-prone sites without the necessity of building in the flood plain.
   B. Revisions to the building codes applicable to such areas requiring strengthening of foundations and footings, and other flood proofing measures.
5. The City shall require flood hazard studies as an integral portion of all environmental impact reports, with detailed flood hazard mitigation measures, for all projects in potential flood hazard areas.

APPENDIX

A. Modified Mercalli Scale

B. Richter Magnitude Scale

C. Prominent Earthquakes in California

D. Glossary Terms

Prominent earthquakes in California, 1769 through September 1971 **

(Intensity VIII and above)

Date		Region	Richter Magnitude	Modified Mercalli Intensity
28	Jul 1769	Los Angeles region	*	
8	Dec 1812	Southern California		VIII-IX
21	Dec	Off coast of southern California		X
10	Jun 1836	San Francisco Bay		IX-X
	Jun 1838	San Francisco region		X
10 or 11	Jul 1855	Los Angeles County		VIII
9	Jan 1857	Near Fort Tejon	Possibly 8	X-XI
26	Nov 1858	San Jose		VIII
12	Nov 1860	Humboldt Bay		VIII
3	Jul 1861	Near Livermore		VIII
1	Oct 1865	Fort Humboldt-Eureka area		VIII-IX
8	Oct	Santa Cruz Mountains		VIII-IX
21	Oct 1868	Hayward		IX-X
26	Mar 1872	Near Lone Pine	Possibly 8	X-XI
19	Apr 1892	Vacaville		IX
21	Apr	Winters		IX
4	Apr 1893	Northwest of Los Angeles		VIII-IX
20	Jun 1897	Near Hollister		VIII
14	Apr 1898	Mendocino area		VIII-IX
22	Jul 1899	San Bernardino County		VIII
25	Dec	San Jacinto-Hemet area		IX
27 & 31	Jul 1902	Santa Barbara County		VIII
18	Apr 1906	San Francisco region	8.3	XI
18	Apr	Brawley, Imperial Valley	6 to 6.9	VIII
28	Oct 1909	Humboldt County	6+	VIII
11	Jan 1915	Los Alamos		VIII
22	Jun	El Centro-Calexico-Mexicali area	6.25	VIII
21	Apr 1918	San Jacinto-Hemet area	6.8	IX
21	Jun 1920	Inglewood		VIII
10	Mar 1922	Cholame Valley	6.5	IX
29	Jun 1925	Santa Barbara area	6.3	VIII-IX
22	Oct 1926	Monterey Bay	6 to 6.9	VIII
20	Aug 1927	Humboldt Bay		VIII
4	Nov	West of Point Arguello	7.5	IX-X
25	Feb 1930	Westmorland	5.0	VIII
1	Mar	Brawley	4.5	VIII
6	Jun 1932	Humboldt County	6.4	VIII
10	Mar 1933	Near Long Beach	6.3	IX
7	Jun 1934	Parkfield	6.0	VIII
18	May 1940	Imperial Valley	7.1	X
30	Jun 1941	Santa Barbara-Carpinteria area	5.9	VIII
15	Mar 1946	North of Walker Pass	6.25	VIII
29	Jul 1950	Imperial Valley	5.5	VIII
21	Jul 1952	Kern County	7.7	XI
22	Aug	Bakersfield	5.8	VIII
25	Apr 1954	East of Watsonville	5.25	VIII
21	Dec	Eureka	6.6	VII
8	Apr 1968	Northeast San Diego County	6.5	VII
1	Oct 1969	Santa Rosa	5.7	VII-VIII
9	Feb 1971	San Fernando	6.6	VIII-XI

* The Richter magnitude scale was not devised until 1931. If values appear in this column for earthquakes which occurred prior to that date, the magnitudes were determined as follows: 1) if given to the nearest tenth, the records of older instruments were correlated with records of instruments now in use; 2) otherwise, historical records of intensity were used to estimate magnitude.

California Geology

**Source: "Planner's Guide to Seismic Safety Element" - Assoc. of Engineering Geologists

THE MERCALLI INTENSITY SCALE

(As modified by Charles F. Richter in 1956 and rearranged)

If most of these effects are observed	*then the intensity is:*
Earthquake shaking not felt. But people may observe marginal effects of large distance earthquakes without identifying these effects as earthquake-caused. Among them: trees, structures, liquids, bodies of water sway slowly, or doors swing slowly.	*I*
Effect on people: Shaking felt by those at rest, especially if they are indoors, and by those on upper floors.	*II*
Effect on people: Felt by most people indoors. Some can estimate duration of shaking. But many may not recognize shaking of building as caused by an earthquake; the shaking is like that caused by the passing of light trucks.	*III*
Other effects: Hanging objects swing. ***Structural effects:*** Windows or doors rattle. Wooden walls and frames creak.	*IV*
Effect on people: Felt by everyone indoors. Many estimate duration of shaking. But they still may not recognize it as caused by an earthquake. The shaking is like that caused by the passing of heavy trucks, though sometimes, instead, people may feel the sensation of a jolt, as if a heavy ball had struck the walls. ***Other effects:*** Hanging objects swing. Standing autos rock. Crockery clashes, dishes rattle or glasses clink. ***Structural effects:*** Doors close, open or swing. Windows rattle.	*V*
Effect on people: Felt by everyone indoors and by most people outdoors. Many now estimate not only the duration of shaking but also its direction and have no doubt as to its cause. Sleepers wakened. ***Other effects:*** Hanging objects swing. Shutters or pictures move. Pendulum clocks stop, start or change rate. Standing autos rock. Crockery clashes, dishes rattle or glasses clink. Liquids disturbed, some spilled. Small unstable objects displaced or upset. ***Structural effects:*** Weak plaster and Masonry D* crack. Windows break. Doors close, open or swing.	*VI*
Effect on people: Felt by everyone. Many are frightened and run outdoors. People walk unsteadily. *Other effects:* Small church or school bells ring. Pictures thrown off walls, knicknacks and books off shelves. Dishes or glasses broken. Furniture moved or overturned. Trees, bushes shaken visibly, or heard to rustle. *Structural effects:* Masonry D* damaged; some cracks in Masonry C*. Weak chimneys break at roof line. Plaster, loose bricks, stones, tiles, cornices, unbraced parapets and architectural ornaments fall. Concrete irrigation ditches damaged.	*VII*
Effect on people: Difficult to stand. Shaking noticed by auto drivers. *Other effects:* Waves on ponds; water turbid with mud. Small slides and caving in along sand or gravel banks. Large bells ring. Furniture broken. Hanging objects quiver. *Structural effects:* Masonry D*.heavily damaged; Masonry C* damaged, partially collapses in some cases; some damage to Masonry B*; none to Masonry A*. Stucco and some masonry walls fall. Chimneys, factory stacks, monuments, towers, elevated tanks twist or fall. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Decayed piling broken off.	*VIII*
Effect on people: General fright. People thrown to ground. *Other effects:* Changes in flow or temperature of springs and wells. Cracks in wet ground and on steep slopes. Steering of autos affected. Branches broken from trees. *Structural effects:* Masonry D* destroyed; Masonry C* heavily damaged, sometimes with complete collapse; Masonry B* is seriously damaged. General damage to foundations. Frame structures, if not bolted, shifted off foundations. Frames racked. Reservoirs seriously damaged. Underground pipes broken.	*IX*
Effect on people: General Panic. *Other effects:* Conspicuous cracks in ground. In areas of soft ground, sand is ejected through holes and piles up into a small crater, and, in muddy areas, water fountains are formed. *Structural effects:* Most masonry and frame structures destroyed along with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes and embankments. Railroads bent slightly.	*X*
Effect on people: General panic. *Other effects:* Large landslides. Water thrown on banks of canals, rivers, lakes, etc. Sand and mud shifted horizontally on beaches and flat land. *Structural effects:* General destruction of buildings. Underground pipelines completely out of service. Railroads bent greatly.	*XI*
Effect on people: General panic. *Other effects:* Same as for Intensity X. *Structural effects* Damage nearly total, the ultimate catastrophe. *Other effects:* Large rock masses displaced. Lines of sight and level distorted. Objects thrown into air	*XII*

* Masonry A Good workmanship and mortar reinforced, designed to resist lateral forces.
Masonry B Good workmanship and mortar, reinforced
Masonry C. Good workmanship and mortar, unreinforced
Masonry D Poor workmanship and mortar and weak materials, like adobe

Source: "Urban Geology Master Plan for California - Phase I"
Division of Mines and Geology

RICHTER MAGNITUDE SCALE*

The Richter Magnitude Scale, named after Dr. Charles F. Richter, Professor Emeritus of the California Institute of Technology, measures the energy of an earthquake at its source, and is the scale most commonly used but often misunderstood. On this scale, the earthquake's magnitude is expressed in whole numbers and decimals. However, Richter magnitudes can be confusing and misleading unless the mathematical basis for the scale is understood. It is important to recognize that magnitude varies logarithmically with the wave amplitude of the quake recorded by the seismograph. Each whole number step of magnitude on the scale represents an increase of 10 times in the measured wave amplitude of an earthquake, and an increase of 31 times in the amount of energy released by the quake. Thus, the amplitude of an 8.3 earthquake releases almost one million times more energy than one of magnitude 4.3.

A quake of magnitude 2 on the Richter Scale is the smallest quake normally felt by humans. Earthquakes with a Richter magnitude 7 or more are commonly considered to be major. The Richter magnitude scale has no fixed maximum or minimum; observations have placed the largest recorded earthquakes in the world at about 8.9, and the smallest at about 3. Earthquakes with magnitudes smaller than 2 are called "micro-earthquakes". Richter magnitudes are not used to estimate resulting earthquake damage. An earthquake in a densely populated area, which results in many deaths and considerable damage, may have the same magnitude as an earthquake that occurs in a barren, remote area, that may do nothing more than frighten the wildlife.

*Source: "Los Angeles Seismic Safety Element"

GLOSSARY TERMS

ACCELERATION

Rate of change in velocity, felt as a force by objects. Measured here in g's, where 1.0g is the acceleration of gravity.

AFTERSHOCKS

A sequence of smaller shocks following an earthquake.

ALLUVIUM

Geologically recent surface deposits, which have not undergone significant cementation or consolidation. Typically sands, gravels, silts, or clays.

ANTICLINAL STRUCTURE

An elongated fold in a rock mass where the slides or limbs slope downward away from the crest.

ASEISMIC

Earthquake resistant.

BEDROCK

The solid, undisturbed rock in place either at the surface or beneath superficial deposits of soil.

CREEP

An imperceptibly slow, more or less continuous downward and outward movement of slope-forming soil or rock.

EPICENTER

The point on the earth's surface directly above the focus of an earthquake.

FAULT

A plane of breakage in rock or soil, along which significant (greater than an inch or so) offsetting of the two sides of the plane has taken place, due to tectonic forces.

FAULT SCARP

A relatively steep, straight ground slope which is caused by the movement along a fault.

FAULT TRACE

The line of intersection of a fault surface with the earth's surface.

FAULT ZONE

Consists of numerous interlacing small faults.

GROUND BREAKAGE AND LURCHING

Surface cracking or distortion due to motions of the ground during an earthquake. Not necessarily directly connected to a fault plane.

GROUND FAILURE

Possible effect of seismic activity on earth materials including but not limited to landsliding, surface rupture, liquefaction, compaction, and subsidence.

GROUND SHAKING

Motions of the soil or rock during an earthquake. May or may not result in breakage, lurching, or other phenomena.

GROUND WATER

That part of the subsurface water which is in the zone of saturation.

INTENSITY (MERCALLI)

The degree of shaking at a specified place; rated by an experienced observer using a descriptive scale.

LANDSLIDE

The downward and outward movement of soil, rock, or other earth materials.

LINEAR SYSTEMS, NODES, AND CORRIDORS

A linear system is a network of facilities and rights-of-way providing for the delivery of a commodity or service. Examples include roadways, pipelines, electrical transmission lines and facilities, channels, and communication networks. Such systems are characterized by nodes which may represent an origin, terminus, or intersection of one or more rights-of-way. Corridors have been defined as routes carrying one or more linear systems or segment thereof.

LIQUEFACTION

The sudden loss of strength of soils under saturated conditions due to earthquake shock.

LUPCHING

Sudden motion at ground surface due to acceleration of the subsoil from earthquake shock.

MAXIMUM POSSIBLE EARTHQUAKE

The largest earthquake which the geologist estimates could ever occur on the given fault. The probability of such an earthquake occurring is considered to be extremely remote.

MAXIMUM CREDIBLE EARTHQUAKE

The largest earthquake which the geologist estimates may occur within the life of the proposed structures (50 - 100 years) on the given fault. The probability of such an earthquake is considered to be low, but is definitely within the realm of possibility.

MAXIMUM PROBABLE EARTHQUAKE

The largest earthquake which the geologist estimates is likely to occur on the given fault within the life of the structure (50 - 100 years).

MUD FLOW

The downward and outward movement of soil and rock or other earth materials in a plastic or near liquid state.

OFFSET

The horizontal and/or vertical distance between two parts of a faulted bed previously joined.

PLEISTOCENE

The next-to-the-last epoch of geologic time; corresponding with the last ice age; its duration was only about 3 million years.

POSSIBLE GROUND RUPTURE ZONE

For the present study, any mapped fault or historic breakage longer than 1/2 mile in length, with the zone 1/8 mile wide in rock and 1/2 mile in soil.

QUATERNARY

The second of the two Cenozoic time periods; encompassed both the Pleistocene and Holocene epochs.

REVERSE FAULT

A steeply inclined fault, on which motion is primarily in a vertical sense, with the "over hanging" side moving upward.

(RICHTER) MAGNITUDE

A measure of the energy released by an earthquake at its source.

RIGHT OR LEFT LATERAL FAULT

A fault on which relative motion is primarily in a horizontal sense, with the motion of the opposite side of the fault, when viewed from one side, to either the right or left, respectively.

ROCK FALL

The vertical movement of rock.

SEICHE

The oscillation or sloshing of water in a lake, bay, or other enclosed body of water caused by seismic activity, or landsliding.

SEISMICITY

A general term, relating to the general level of earthquake activity in an area.

SLOPE STABILITY

The ability of a slope of soil or rock materials to resist moving downhill.

STRATIGRAPHY

Deals with the formation, composition, sequence, and correlation of the stratified rocks as part of the earth's crust.

SUBSIDIARY FAULTS

Auxiliary cracks either branching obliquely or lying subparallel to the main line of rupture.

SUBSIDENCE

A local mass movement of earth material in which surface material is displaced vertically downward as an aereal settlement with little or no horizontal component.

SURFACE RUPTURE

Ground breakage at the surface caused by faulting.

TECTONIC

Designating or pertaining to changes in the structure of the earth's crust, the forces responsible for such deformations, or the external forms produced.

THRUST FAULT

A fault that has a low angle of inclination with reference to a horizontal plane.

TSUNAMI

A sea wave generated by a submarine earthquake, landslide, or volcanic activity.